

October 2018
Washington, D.C.

STRATEGY GUIDE

**Making It Count: Strategies for
Improving Mathematics
Instruction for Students in
Short-Term Facilities**

Second Edition

**Peter Leone
Carolyn Fink
Michael Wilson
Candace Mulcahy**

The National Technical Assistance Center for the Education of Neglected or Delinquent Children and Youth

This document was developed by the National Technical Assistance Center for the Education of Neglected or Delinquent Children and Youth (NDTAC), which is funded by a contract awarded by the U.S. Department of Education to the American Institutes for Research (AIR) in Washington, D.C. The mission of NDTAC is to improve educational programming for youth who are neglected, delinquent, or at risk of academic failure. NDTAC's mandates are to provide information, resources, and direct technical assistance to States and those who support or provide education to youth who are neglected or delinquent, to develop a model and tools to assist States and providers with reporting data and evaluating their services, and to serve as a facilitator to increase information-sharing and peer-to-peer learning at the State and local levels. For additional information on NDTAC, visit <https://neglected-delinquent.ed.gov/>.

Suggested Citation

Leone, P., Fink, C., Wilson, M., & Mulcahy, C. (2018). *Making it count: Strategies for improving mathematics instruction for students in short-term facilities* (2nd ed.). Washington, DC: American Institutes for Research, National Technical Assistance Center for the Education of Neglected or Delinquent Children and Youth.

The content of this document does not necessarily reflect the views or policies of the U.S. Department of Education. This document was produced by NDTAC at AIR with funding from the Student Achievement and School Accountability Programs, Office of Elementary and Secondary Education, U.S. Department of Education, under contract no. ED-ESE-15-O-5037. Permission is granted to reproduce this document.

Introduction

This guide is a revised and updated edition of *Making It Count*, first published by the National Technical Assistance Center for the Education of Neglected or Delinquent Children and Youth (NDTAC) at the American Institutes for Research (AIR) in 2010. This version contains much of the information from the earlier publication but also includes strategies for using project-based learning and Web-based instructional programs to support the development of mathematics proficiency for youth in short-term juvenile correctional facilities. Mathematics proficiency includes mastery and fluency in foundational numeracy; an understanding of complex, grade-appropriate concepts and procedures; and application of those competencies to solve relevant, real-life problems.

This guide is primarily designed to help practitioners implement research-based, effective mathematics instruction in short-term facilities, defined as institutions that typically house youth detained in juvenile corrections or other residential facilities for periods of 90 days or less. A secondary audience includes local juvenile justice facilities program coordinators, facility administrators, and State Title I, Part D coordinators.

This guide provides recommendations, strategies, and examples for teachers that increase the likelihood that students will become more proficient at understanding mathematics and applying existing and emerging skills. Just as important, the guide can help teachers promote the self-confidence of students in their ability to use mathematics to solve problems.

The number of youth in residential custody for delinquency continues to fall across the United States. The most current data, the one-day count, showed that 48,043 children under age 21 were held in 1,772 publicly and privately operated facilities throughout the United States in October 2015.¹ This number includes youth in state training schools and other residential treatment facilities, detention centers, and group homes. Short-term facilities such as detention centers may hold some youth overnight and other youth for more than 60 days.

According to the most current Title I, Part D program data, the average length of stay for youth in Subpart 2 these detention facilities was 58 days; the majority of youth served in locally operated detention, and the majority of all detained youth were between 14 and 18 years old. African-American youth represented the largest group of detainees followed by White, non-Hispanic youth; Hispanic youth; and a smaller number of American Indian/Alaska Native and Asian/Pacific Islander youth. Seventy-seven percent of youth in juvenile detention receiving Title I, Part D funds were males.² Research provides some information on the academic abilities and school experiences of youth in detention.

Two studies of a large sample of adolescent boys and girls at intake in juvenile corrections in a mid-Atlantic state shed light on the academic performance of incarcerated youth. One study found that adolescent boys scored, on average, 4 years below their age-equivalent peers on standardized tests in both reading and mathematics.³ In a comparable investigation in the same State, researchers assessed and interviewed 273 incarcerated girls.⁴ They found reading and mathematics scores substantially below the girls' expected age-level performance. With regard to prior school experience, both investigations found that detained youth experienced high rates of suspension, retention in grade, and expulsion from school prior to their incarceration. More than 80 percent of the more than 500 boys assessed had been suspended from school, more than 60 percent had been retained in grade, and more than 50 percent had been expelled from school prior to incarceration. Like their male counterparts, more than 80 percent of the girls had been suspended from school, 55 percent had been retained, and 46 percent had been expelled prior to incarceration.

The academic skill levels and previous school experiences of the youth in your detention center or other short-term facility may differ from those of the youth in these studies. Most likely they will exhibit, with some exceptions, academic abilities below their nonincarcerated peers and a history of exclusion and other negative school experiences. At least half or more of them will have a history of receiving special education services. This background information

¹ Office of Juvenile Justice and Delinquency Statistical Briefing Book. (2016). Juvenile residential facility census, 2004: Selected findings. *Juvenile Offenders and Victims National Report Series*. Washington, DC: Office of Juvenile Justice and Delinquency Prevention; also Sickmund, M., Sladky, T. J., Kang, W., & Puzanchera, C. (2017). *Easy access to the census of juveniles in residential placement*. Retrieved from <http://www.ojjdp.gov/ojstatbb/ezacjrp/>

² Data from Title I, Part D, 2015–2016, United States, Subpart 2. <https://neglected-delinquent.ed.gov/fast-facts/united-states?subpart=2>

³ Krezmien, M. P., Mulcahy, C. A., & Leone, P. E. (2008). Detained and committed youth: Examining differences in achievement, mental health needs, and special education status. *Education and Treatment of Children*, 31(4), 445–464.

⁴ Wilson, M., Zablocki, M., & Bartolotta, R. (2007). *Educational and behavioral status of females in a state juvenile detention and commitment facility*. Presentation at the Council for Exceptional Children meeting, Louisville, KY.

will be valuable as you shape your classroom climate and culture, establish expectations, and design assessment and teaching activities that are associated with improving mathematics outcomes among the youth in your facility.

Recommendations for Mathematics Instruction and Numeracy Activities

This guide presents four recommendations and 22 related strategies for improving mathematics proficiency, including numeracy, for students in short-term facilities. The recommendations focus on (1) engaging students, (2) assessing and monitoring students, (3) teaching students, and (4) developing an infrastructure at juvenile justice facilities to support high-quality learning opportunities. The guide offers multiple strategies and examples for enacting each of the four recommendations, with a focus on addressing the challenges and talents that are typically presented by students in short-term juvenile facilities.

Recommendation 1: Promote student engagement and a classroom environment conducive to learning.

The goal of mathematics instruction in detention facilities should be threefold: (a) rapidly improve students' foundational skills, procedural fluency, and conceptual understanding; (b) provide access to grade-appropriate mathematics concepts and domains (e.g., algebra, geometry); and (c) instill mathematics competence and confidence in students who have likely experienced major gaps in instruction and years of failure in mathematics.

Student engagement and a positive classroom culture and climate are closely related to each other and to individual students' foundational numeracy and grade-appropriate concept development. Motivated students actively take part in and feel responsible for their own learning. Therefore, it is important for teachers, particularly those teaching learners with diverse backgrounds and needs, to engage their students through motivational activities.

Engaging students in juvenile facilities in numeracy activities may be particularly challenging for teachers because many of these students have experienced repeated academic failure and exhibit low mathematics achievement. Thus, students may enter class with poor attitudes toward numeracy, low levels of confidence in their mathematics ability, and an unwillingness to persist through complex mathematics tasks. Moreover, it may be

difficult for students to identify the relevance of mathematics in their lives, and, consequently, they may find little intrinsic value in the work.

The TED-Ed math video series can be a fun and engaging way to introduce real-world problem solving to students.
<https://ed.ted.com/lessons?category=mathematics>

In addition to motivation, learning may be affected by the context of the learning space.⁵ In other words, students' willingness to engage in learning is influenced by the inclusiveness of the classroom environment. Therefore, teachers in juvenile facilities must be culturally competent and should recognize and integrate student diversity in the classroom. Teachers should be willing to engage in behaviors that support an inclusive classroom climate. Specifically, teachers must be aware of their own cultural understandings and how this understanding may influence their interactions with students. For example, teachers attempting to improve classroom culture should avoid deficit thinking about students' sociolinguistic differences and their academic skill levels. Instead of criticizing, explicitly or implicitly, students' language abilities, especially those of minority students and English learners, teachers should help students understand the differences between formal classroom language and the language that students use with friends and family. Teachers who are positive and caring create the conditions and a classroom climate that are essential to engage students. At the same time, demonstrating caring behavior toward students does not mean ignoring appropriate boundaries that should exist in the teacher-student relationship. Students' sense of safety and engagement can be tied closely to teacher-student interactions.

Despite the challenges in motivating students in numeracy and mathematics, teachers can use a number of strategies that are likely to engage students and increase their motivation to participate and invest in mathematics learning. Given that students in detention facilities tend to be heterogeneous, planning for multiple learning styles and using Universal Design for Learning principles⁶ can amplify engagement. Planning to represent content in different ways (visual, manipulatives) and allowing for multiple methods for students to show what they know (offer scaffolds, self-assessment) can allow for full participation of students with disabilities.

⁵ Bandura, A. (1975). *Social learning and personality development*. New York, NY: Holt, Rinehart & Winston.

⁶ See <http://udlguidelines.cast.org/>.

1. Use informal and formal channels to learn about and engage students.

To create a sense of community within the school and classrooms, it is important for teachers and other facility staff to engage students. But first, teachers must learn and understand the interests, experiences, and educational backgrounds of the students when they enter the facility. Teachers who show their students that they are “real people” who care about them can help create a trusting and engaging climate for students.

Juvenile facility staff can use informal discussions and formal surveys to learn about their students. In addition, educators should review educational records that have been sent to the facility and familiarize themselves with any extant data on the students’ learning experiences, including experiences with mathematics and numeracy.

After becoming familiar with students’ backgrounds and interests, teachers can create real-life, meaningful mathematics activities that are relevant to students’ lives to introduce and practice numeracy and grade-appropriate mathematics concepts.

2. Develop a classroom climate focused on high expectations for mathematics.

Even though many students in juvenile facilities have experienced failure in mathematics and may have considerable deficits in numeracy, teachers should set high expectations for student learning. All students should be expected to master the objectives that are delineated in the curriculum standards, thereby establishing uniform standards of expectations. Students also need to be given the academic support to realize the high expectations and guidance on how to ask for and access that support.

Homework, tests, and in-class graded work can be kept and maintained in a portfolio by each student. Finally, establishing classroom routines, such as requiring students to calculate and graph their grades to self-monitor progress, can also help keep students focused on academic expectations. Further, sociocultural practices within the facility and the classroom can convey various levels of expectations for student achievement. For instance, language can be a powerful tool for communicating expectations for student achievement and behavior. Consider the not-so-subtle difference in the message sent when staff refer to students as “scholars” instead of “juveniles” or “wards.” Within the classroom, teachers can use the classroom environment, both physical and psychological, to set the expectation for the classroom as a place of learning. As an example, a mathematics teacher in juvenile corrections in California named his classroom the “Think Tank.” This name adorned

the walls outside and inside the classroom, along with drawings of tanks and images to convey a focus on academic learning within the classroom.

3. Incorporate culturally and geographically relevant practices into mathematics instruction.

Culturally relevant practices in the classroom are those that consider the cultural context of students. Teachers should attend to ways they can connect learning to culture and not simply place cultural symbols in the classroom or lessons independent of learning activities. For example, in Texas, many families rely on the Gulf Coast and oil production for their livelihood. Incorporating stories of the fishing industry and oil refineries affected by Hurricane Harvey in 2017 can provide a rich context for discussion and math instruction. Placing the loss of businesses and jobs as a result of this massive storm into mathematics problem-solving opportunities can provide a level of relevance to the youths’ lives. Similarly, recent wildfires in the western States provide an opportunity to estimate and measure the impact of these events on families, communities, and industry. Relevant mathematics (and science) activities provide an opportunity to incorporate stories, experiences, symbols, and language into problem-solving opportunities. These events can promote engagement and a sense of classroom community.

In attempting to incorporate culture into teaching practices, teachers should also account for a number of other cultural considerations. The cultural makeup of a typical juvenile facility classroom can differ across generation, race, class, religion, and geographic orientation. For example, one teacher used a cultural ritual common among young males involved in hip-hop culture, called *battling*, to engage students in the practice of solving equations and communicating mathematics knowledge. *Battling* involves two or more individuals orally reciting hip-hop lyrics in a contest with one another. In this mathematics example, students were presented with separate equations to solve and won points in the battle on the basis of how accurate their solutions were and how well they communicated their ideas for solving the problem. *Battling* can be used for practicing and reinforcing foundational numeracy skills or for solving higher order mathematics problems.

4. Use games and constructive competition to practice and review numeracy skills.

Creating spaces where students can be competitive in constructive ways can be an engaging motivational tool. Having students use games to practice newly acquired skills or to evaluate skills can be effective. Teachers might consider applying the rules of popular sports games to a game focused on numeracy.

One easy and effective competitive application of numeracy practice is math bingo. A teacher in a juvenile detention center in Maryland uses multiplication bingo at the end of many classes to help students practice multiplication, an important numeracy skill. The teacher says that the activity gives students an opportunity to practice a skill that many of them struggle with and to compete in a constructive way. Students can also work in pairs or small groups to represent and solve algebraic equations using manipulatives. Points are awarded to the group that accurately represents a problem using manipulatives such as algebra tiles. Then, additional points are awarded to the group that accurately solves the problem first. Battling, math bingo, and the representation and solution examples can be helpful in improving fluency and providing opportunities for mathematics practice and productive student interaction and engagement.

5. Use meaningful, relevant incentives to encourage student engagement.

Using motivational tools can help bridge gaps of interest as well as socio- and generational culture that traditional pedagogy may ignore. Giving students an incentive to complete academic tasks can be very effective. For example, teachers might consider allowing students to listen to their own music during independent seatwork. Alternatively, to encourage cooperative support toward goal achievement, teachers might provide a classroom incentive such as a weekly party as a reward for all students who successfully complete assigned work for the week. Involving students in developing a set of desirable incentives will also promote student engagement. Weekly parties can be used either as a tool for individual goal-setting (i.e., only students who earn the reward by completing assigned work participate in the party) or as a cooperative goal (i.e., students work together to achieve a common goal). These techniques help build individual and group responsibility and nurture a positive classroom climate.

Incentives and other motivational activities are not intended to replace or undermine the intrinsic value of learning. However, motivational activities recognize the limitations of the intrinsic motivational stance in practical application.

6. Incorporate project-based learning into the instructional routine.⁷

Project-based learning (PBL), also known as problem-based or inquiry-based learning, has been used in schools

in recent years to engage students and improve math outcomes for typical students and underachievers. Most of the examples and activities described in the professional literature come from elementary and secondary school programs across the United States. However, several juvenile correctional education programs have incorporated PBL into their classroom routines. Often, as is the case with PBL, a holistic unit of instruction will include the use of not just math concepts and skills but also facets of language arts, social studies, science, and the arts.

Some evidence suggests that PBL can improve critical thinking, communication, and collaboration.⁸ Key elements of PBL include a driving question, investigation, and student autonomy. PBL prompts students to study questions that have personal relevance and provides them with opportunities to work collaboratively.

Recommendation 2: Implement screening, diagnostic testing, and progress monitoring.

Facilities receiving Title 1, Part D funding must conduct pre/post testing on all youth served for more than 90 days. Many public school teachers have started using curriculum-based measures (CBMs) because they provide an easy and effective way to monitor student progress and can be used in juvenile corrections classrooms to respond to the pre/post assessment requirement. An advantage of using CBMs in detention facilities is that with the high mobility of students, facility staff can capture academic progress during the student's stay, regardless of length.

All programs should conduct screening and diagnostic testing of the mathematics skills of individual students as well as ongoing progress monitoring to inform instruction. An effective evaluation system should include initial screening and in-depth diagnostic testing to get the best picture of each student's mathematical strengths and weaknesses, as well as progress monitoring to get the best picture of what the student has learned and still needs to learn. Progress monitoring should be continuous, assess the achievement gains of students throughout their programming, and use curriculum-based measures to ensure that the teaching strategies are working and are sufficient. The following section provides specific considerations for administrators, teachers, and staff developers as they put into place an assessment program that includes screening, diagnostic testing, and progress monitoring.

⁷ See <http://www.bie.org/resources>.

⁸ Ravitz, J., Hixson, N., English, M., & Mergendoller, J. (2012, April 16). *Using project-based learning to teach 21st century skills: Findings from a statewide initiative*. Paper presented at AERA meeting, Vancouver, BC, Canada. Retrieved from <https://tinyurl.com/y8f9e8yk>; see also Mosier, G. G., Bradley-Levine, J., & Perkins, T. (2016). Students' perceptions of project-based learning within the New Tech School model. *International Journal of Educational Reform*, 25(1), 2–16.

Considering the limited and variable time available to educators in short-term juvenile facilities, programs and teachers need to implement a comprehensive academic evaluation system. The evaluation system should include gathering available information on the students' past and current performance in mathematics, including teacher reports, report cards, individualized education plans, and student products. The evaluation system must allow teachers to develop an appropriate individualized course of study that can be used during each student's stay in the facility. Ideally, the evaluation and the course of study would follow the student to his or her subsequent placement.

1. Use initial screening to develop a broad picture of students' abilities.

Facility administrators should institute a policy requiring all students who enter the facility to take part in a broad screening of their mathematics knowledge. This screening can be conducted using a short tool, administered individually, to quickly assess students' mathematical capabilities across a broad array of skill areas. Although the screening instrument should be brief, it is important that test items align with the content priorities of the curriculum standards. This screening should be sensitive to the physical, emotional, and psychological status of youth entering the facility yet must require participation in screening within a reasonable amount of time. It may be necessary to delay screening to prevent unwanted effects such as invalid results or escalation of emotional distress. However, facility administrators should develop guidelines that allow relevant staff to address issues of toxicology or emotional distress and still conduct screening within about 5 days of entry. A widely used screening tool is the mathematics sections of the Woodcock-Johnson III.

In addition to intake academic screening, facilities should have in place a system for transferring school records from the students' previous school placements. Some systems have successfully set up electronic databases that allow facility staff to immediately access records when students are placed in the juvenile facility. In addition to reviewing and analyzing school records, facility staff can use student interviews as a useful tool for collecting information on students' mathematics history. Interviews should inquire about students' strengths, weaknesses, interests, and past school experiences (i.e., retention, expulsion, attendance lapses, special education service, mental health service, course taking).

2. Use diagnostic testing to identify students' strengths and weaknesses.

Following the broad screening of foundational numeracy skills and mathematics concepts, an in-depth diagnostic testing of areas of particular strength and weakness should be conducted. Such diagnostic testing can provide valuable insight into the foundational skills on which to focus during a student's stay. These skills should also be outlined in the student's education plan.

The appropriateness of tests is of vital concern to all test users. Questions on the diagnostic test should assess across appropriate content and process standards.⁹ In addition, testers, as well as consumers of test reports (teachers), should be aware of test properties such as the reliability and validity of the test for the individual student.

Students identified with disabilities or, in many localities, English learners are highly represented among youth in juvenile facilities. Therefore, assessors must be prepared to use appropriate accommodations for these students to ensure the accuracy of test results. Appropriate accommodations may include differentiating test presentation, response modes, settings, and scheduling for students with disabilities or using translated texts for students with limited English language proficiency.¹⁰

Diagnostic testing can take the form of commercial tests (e.g., KeyMath), instructor-developed curriculum-based assessments, or diagnostic interviews. During a diagnostic interview, the instructor presents the student with several mathematics problems. As the student solves the problems, the instructor asks him or her to explain the processes and thinking the student is using. Diagnostic interviews are conducted to gather qualitative performance data regarding a student's (a) content knowledge, cognitive processes, (c) strategy use, and (d) disposition to mathematics.

Items on diagnostic tests appropriate for student assessment should be aligned with the standards and principles delineated by the National Council of Teachers of Mathematics,¹¹ the Common Core State Standards, and State and local mathematics standards.

3. Use progress monitoring to assess students' mastery of foundational numeracy skills and content standards.

CBMs are brief tests given regularly (weekly) to students to assess their progress in mastering an academic skill. CBMs, one type of curriculum-based assessment, are standardized, brief, timed, and graphed by the teacher or

⁹ See <http://www.corestandards.org>.

¹⁰ Salvia, J., Ysseldyke, J. E., & Bolt, S. (2010). *Assessment in special and inclusive education* (11th ed.). Boston, MA: Wadsworth.

¹¹ See <https://www.nctm.org/standardspositions/>.

student. CBMs are used to measure fluency and accuracy and are typically used for foundational skills. They are also sensitive to changes during a short amount of time and can be normed. Progress monitoring is necessary to support student learning and use instructional strategies efficiently. Although progress monitoring is important in all learning situations, it is particularly important when students lack grade-level skills and will be in a facility for a short time. For example, a teacher can construct a series of tests with items assessing a student's skill in graphing functions. The teacher would then track the change in the number of items correct from week to week on the series of tests. In addition, the student can self-monitor and graph his or her own progress on CBMs.

To evaluate student progress as a result of numeracy activities in the classroom, teachers should use tests aligned with the specific curricular goals enacted with students. In addition, this alignment allows teachers to determine student learning in numeracy skill area deficits identified during screening or diagnostic testing and addressed in students' educational plans.¹²

Although tests are an important component of progress monitoring, they should not be the only component. Teachers should use formal and informal observations, student products, diagnostic interviews, and communications with other teachers to evaluate student progress in relevant numeracy skill areas and other mathematics concepts.

Recommendation 3: Use explicit instruction by knowledgeable teachers to teach new numeracy skills and grade-appropriate mathematics concepts.

Although classroom climate and culture and the effective diagnosis of students' mathematics strengths and weaknesses set the stage for instruction, student-teacher interactions—the actual instruction—directly affects students' mathematics proficiency. Effective teachers in short-term facilities can have a substantial effect on both remediating and advancing their students' numeracy skills and overall mathematics proficiency. Effective mathematics teachers are knowledgeable about relevant mathematics content and use this deep understanding of

mathematics content to more effectively teach the concepts of numeracy.

In addition to having deep content knowledge, teachers should use explicit instruction of content. Explicit instruction is effective for teaching numeracy concepts and processes, particularly for students at basic skill levels in mathematics.¹³ Explicit instruction can be an effective teaching practice that supports the acquisition of new mathematics facts.

1. Provide instruction that is flexible to meet the variable lengths of stay of students in detention.

Youth in detention tend to have variable lengths of stay; one youth may enter and leave a facility in just a few days, whereas others may remain for 90 days or more while they await placement in a long-term facility. Because students enter and leave class intermittently and sometimes unpredictably, mathematics instruction should be tailored to a highly mobile student population with a wide range of abilities. Teachers need to provide short-term (i.e., weeklong) instructional units that focus on remedial numeracy as well as grade-appropriate concepts and problem-solving skills.

¹² For an in-depth discussion of developing curriculum-based measures for progress monitoring, see Hosp, M. K., Hosp, J. L., & Howell, W. (2016). *The ABCs of CBM, second edition: A practical guide to curriculum-based measurement*. New York, NY: Guilford Press.

¹³ Maccini, P., & Gagnon, J. C. (2000). Best practices for teaching mathematics to secondary students with special needs. *Focus on Exceptional Children*, 32, 1–21.

For example, a weeklong instructional unit on the area and perimeter of parallelograms might follow this schedule:

Sample Schedule for a Weeklong Instructional Unit on the Area and Perimeter of Parallelograms

Monday:

- Teacher: Determine prerequisite skills and current knowledge by using a CBA.
- Students: Classify quadrilaterals.
- Teacher: Review vocabulary related to area and perimeter of parallelograms.

Tuesday:

- Teacher: Review formulas for area and perimeter of triangles and rectangles.
- Students: Apply knowledge of area and perimeter formulas for triangles and rectangles to finding area and perimeter of parallelograms.
- Teacher: Provide additional instruction on prerequisite skills necessary for mastery of area and perimeter of parallelograms.

Wednesday:

- Students: Derive a formula for finding area and perimeter of parallelograms.
- Teacher: Provide multiple practice opportunities.

Thursday:

- Students: Using real-world examples, apply knowledge of area and perimeter formulas to solve one-step and multistep problems.

Friday:

- Students: Review and practice concepts and skills from unit.
- Teacher: Administer a CBA to gauge student understanding and mastery of unit.
- Teacher: Administer a curriculum-based measure (CBM) to monitor progress in foundational skills.

2. *Ensure high standards for mathematics instructor's mathematics content knowledge.*

Numerous studies indicate that many U.S. mathematics teachers possess inadequate mathematics content knowledge.¹⁴ Further, the typical variability of students' numeracy skills in juvenile facilities often demands that teachers have a knowledge of mathematics across the elementary and high school curriculum. In addition to recruiting teachers with strong backgrounds in mathematical content, facility administrators should focus ongoing professional development activities on improving the mathematics curriculum content knowledge of their current teachers. Teachers with a deep understanding of mathematics content are better positioned to teach foundational numeracy and grade-appropriate mathematics concepts. In addition to deep content knowledge, teachers should be familiar with explicit instruction of content as it is effective for introducing new concepts, particularly for students with mathematics difficulty.

Michael Woods, a teacher at a juvenile detention center, advises teachers to present lessons in small steps. Also, he presents new information using "little bite-sized lessons, just enough for [students] to get a taste of the topic and have success in it, and then the next day you can reinforce it. But to give [students] 60 minutes of math computations will be completely ineffective."

3. *Integrate explicit instruction into the teaching of mathematics content and processes for both new concepts and the review of previously learned concepts.*

Explicit instruction is an effective teaching practice that can support students in acquiring new mathematics facts. Explicit instruction includes teacher-directed instruction of prerequisite skills, modeling of target skills, guided practice, independent practice, and corrective feedback. Explicit instruction can support the acquisition of factual, procedural, and conceptual knowledge and is supported in research on effective strategies for teaching students with disabilities.¹⁵ Students are not receiving explicit instruction when they are consigned to drill and practice worksheets for long periods of time. Nor are they receiving explicit instruction when mathematics instruction is reduced to show-tell-practice approaches that are devoid of student-engaged activity or application.

Mathematics proficiency and numeracy attainment is hierarchical. In other words, developing new skills is heavily based on understanding previously learned foundational skills. Therefore, it is important that teachers explicitly review and reteach previous knowledge. In addition, lessons should be focused on one skill or concept; each part of the lesson should introduce and reinforce that skill or concept. Students should receive explicit instruction of related vocabulary and multiple demonstrations (modeling) of new skills or concepts.

For example, to provide instruction on solving a linear equation with a variable in the denominator of a fraction, teachers must first ensure that students are familiar with several background concepts. If presenting the problem $x + 4/x + 1 = 5$, teachers need to provide explicit instruction on the three concepts: (1) equations or equivalence in relation to operations performed to an equation; (2) manipulating/multiplying of fractions; and (3) the distributive property. After these constitutive parts have been taught, instruction on solving the equation may begin.

During the modeling phase, students should be encouraged to participate using "think alouds" that ask them to provide the next step in a procedure. Students can then be required to complete the steps at their desks, using manipulatives or personal whiteboards. Maximizing student engagement during the modeling phase of a lesson allows teachers to gauge student understanding and alter instruction accordingly.

Within an explicit instruction framework, providing opportunities for students to guide their own learning is part of a balanced instructional lesson.¹⁶ Student-directed activities may include holding problem-solving sessions where students work together to solve a complex mathematics problem or having students develop their own problems or assessments on the basis of the numeracy lesson. Including opportunities for student-directed instruction within an explicit instruction framework also helps engage and invest students in the instructional activities.

4. *Use guided and independent practice to review acquired numeracy skills.*

Guided practice allows students to demonstrate and check their understanding while teacher direction gradually decreases. With guided practice, teachers incrementally fade, or reduce guidance, to allow students to take increasing responsibility for learning and practice.

¹⁴ National Research Council. (2001). *Adding it up: Helping children learn mathematics*. Washington, DC: The National Academies Press. doi: <https://doi.org/10.17226/9822>

¹⁵ National Mathematics Advisory Panel. (2008). *Foundations for success: The final report of the National Advisory Panel*. Washington, DC: U.S. Department of Education. Retrieved from <https://www2.ed.gov/about/bdscomm/list/mathpanel/index.html>

¹⁶ Explicit instruction is supported by the National Mathematics Advisory Panel. See note 15.

Independent practice is important for developing and maintaining mathematics knowledge.¹⁷ Near the end of the lesson, teachers can incorporate independent practice by using a short, five-question “ticket out.” Providing accurate responses demonstrates student mastery.

In addition to having guided and independent practice time during class, students in juvenile facilities should be expected to complete homework that serves as additional independent practice of skills developed during class. Homework requires strong collaboration between education staff and residential or security staff. Providing a set time in the evenings, with appropriate space and tools for completing homework, reinforces the importance of school and homework and youth as students and learners. Homework should be **practice**, not an introduction to new concepts or skills; therefore, it is the responsibility of teachers to make sure that students fully understand the lesson prior to assigning homework. Ensuring understanding can be accomplished through a daily CBA or other informal measure (e.g., ticket out) at the end of each lesson.

5. *Use questioning and feedback loops to monitor learning.*

Teachers must provide students with feedback throughout the instructional process and use questioning to gauge student understanding and learning during a lesson. Teachers should not only provide feedback that is corrective, noting right and wrong answers, but also they should help students deepen conceptual understanding by exploring the thinking behind students’ answers in terms of how they derived an answer or why they believe their answer is right or wrong. Students should have numerous opportunities to explain their thinking orally and in writing; it should become a routine part of daily lessons.

Teachers should use open-ended questions (e.g., “Why?” “Can you explain that?”) to monitor learning within individual numeracy activities and to provide cumulative assessments of skill areas. This monitoring should take the form of weekly or monthly CBMs. Students can record and graph their progress on CBMs to reinforce progress and further invest in their own learning.

In addition to using CBMs of foundational numeracy skills, teachers should pretest and posttest students at the beginning and end of each unit using an instructor-developed CBA (also known as a unit test). This practice

will help teachers refine and redirect instruction, gauge student mastery of concepts and objectives covered in units, and provide student work for the portfolio.

6. *Use graduated instructional sequencing to teach abstract concepts.*

Graduated instructional sequencing is a research-based strategy for introducing mathematical concepts to students.¹⁸ Graduated instruction is often referred to as the concrete-semiconcrete-abstract (CSA) sequence and can be advantageous for helping students who struggle with the symbolic, or abstract, language of mathematics. For example, the CSA sequence has been effective in teaching algebra to students who are unfamiliar with or unskilled in solving algebraic equations. This strategy may be particularly effective for students who struggle with algebra because they lack conceptual understanding of numbers, symbols, and the relationship between the two. However, the strategy may be used to teach a variety of concepts, such as fractions, percent, geometry, and basic computation.

The first step in a graduated instructional sequence is to introduce students to mathematical (often algebraic) concepts using a concrete item, or manipulative, to represent the concept (concrete stage). Specialized manipulatives or common resources found in the classroom can be used. For example, students may represent numbers and symbols in an algebra equation by using blocks of differing colors and sizes, such as algebra tiles. The concrete stage may last a single lesson or several lessons, depending on student mastery. Using manipulatives in a detention setting requires considerable planning because some manipulatives, such as items that might be used as weapons, may not be appropriate for the environment. As in any classroom, procedures for dispensing and collecting manipulatives need to be developed.

The second step of the sequence is to use pictures to represent the objects used in the first step (semiconcrete stage). Teachers should explicitly identify the link between the pictorial representation and the concrete representation to students. In an explicit instructional cycle, teachers model this several times with student involvement and then provide several opportunities for guided practice. As with the concrete stage, using pictorial representations in the semiconcrete stage may last a lesson or several lessons depending on student mastery.

¹⁷ Hudson, P., & Miller, S. P. (2006). *Designing and implementing mathematics instruction for students with diverse learning needs*. Boston, MA: Pearson Education.

¹⁸ Flores, M. M., Hinton, V., & Strozier, S. (2014). Teaching subtraction and multiplication with regrouping using the concrete-representational-abstract sequence and Strategic Instruction Model. *Learning Disabilities Research & Practice, 29*(2), 75–88.

The final step of the sequence is to use numbers and symbols to represent the equation (abstract stage). Again, teachers should explicitly note the link between the abstract notation of the current step and the representational and concrete examples used in the previous two steps. The abstract stage should not begin until students master problem solving at the semiconcrete stage. The abstract stage could involve a single lesson or several lessons.

For example, teachers might use pencils to represent constants and a pencil box to represent a variable in the simple problem $x + 13 = 20$. In the second step, the pencils and box would be represented in picture form, and the final step would eliminate representations and simply use the variable and constants to represent the problem. Another example might be to use a classroom table, a drawing of the table, and finally the abstract formula for solving for perimeter ($P = 2L + 2W$). This representation of the problem could also be extended into a discussion of how to solve for the width by using the same formula.

7. Use explicit problem-solving strategies.

Cognitive planning strategies, including explicit attention to problem-solving strategies, give students tools for organizing their own thinking when solving mathematical problems. Cognitive organization is important for students who have not developed metacognitive habits on their own. Cognitive planning strategies help students understand how they should be thinking about a problem or organize the problem-solving sequence and are a precursor to metacognitive thinking. Metacognition involves recognizing and understanding one's thinking processes. The ability to use metacognition allows students to plan, choose appropriate strategies, and solve problems by using the best strategy. Teachers should provide explicit instruction in each of these steps to students, using modeling prior to having students practice the strategy independently.

In strategy instruction, students use explicit steps to plan, solve, and check their work in a problem-solving situation. First, students read the problem and ensure that they understand the words in the problem, identify what information is provided, and understand what the problem is asking them to find. Second, students draw a pictorial representation of the problem to be solved. Students may also simply write out the problem as a mathematical equation in this step. Third, students solve the problem based on the pictorial or abstract representation of the

problem employed in Step 2. Fourth, students reexamine their answer and justify why it is correct.

Within a strategy instruction model, students also have opportunities to self-monitor their progress through the steps. For example, in the STAR (Search, Translate the words, Answer the problem, Review the solution) strategy, students have a card that identifies the steps and a space for checking when they complete a step. Self-monitoring is an important part of any strategy instruction approach because it helps build metacognitive skills.

8. Teach students mnemonic devices to remember concepts or processes.

Mnemonic devices can be used within a strategy instruction approach to teach new concepts to students. Mnemonics assist in the memorization of new or difficult concepts by developing artificial cognitive structures that organize and order concepts so that they are mutually evocative. This cognitive structure gives students an easier way to encode and, most important, recall new information. For example, in mathematics, students are taught a mnemonic sentence (**Please Excuse My Dear Aunt Sally**) to remember that parentheses, exponents, multiplication, division, addition, and then subtraction make up the order of operations for solving an equation. Within the strategy instruction approach, the mnemonic is paired with a technique for self-monitoring the use of the mnemonic.

Steven Leinwand, the former mathematics supervisor for the Connecticut Department of Education and currently a principal research analyst at the American Institutes for Research, suggests that teachers emphasize the use and meaning of mathematical terms and their connectedness to the real world.

For example, understanding the relationships between mathematical terms and everyday language (cylinder and can, prism and box, and average and typical) helps students internalize new terminology and concepts in the classroom.

Keyword method. Students use words that sound like the unknown word, which can be associated with pictorial representations to assist encoding and recall of verbal information.¹⁹ For example, students might associate the word “integer” with “finger” and use the mental or physical picture of a finger to recall that an integer is a whole number in the sense that it can be written without a fraction or decimal point.

¹⁹ Scruggs, T. E., & Mastropieri, M. A. (2000). The effectiveness of mnemonic instruction for students with learning and behavior problems: An update and research synthesis. *Journal of Behavioral Education, 10*(2/3), 163–173.

Pegword method. Students use rhyming words (pegwords) to replace numbers that are associated with the information to be recalled. The pegword method can help students recall ordinal information. For example, a pegword for 6 is “stix.” Students can apply this pegword to multiplication facts: 6×6 (Stix \times Stix) = 36 (Dirty Stix).

Acronyms. Students use initial letters as prompts to recall a list of facts. One of the most common acronyms in mathematics is for the order of operations (PEMDAS).

Teacher- and student-developed strategies. Teachers can help students learn procedures for developing their own mnemonics and then have them generalize to various domain areas. It may also be helpful to give students sentences or phrases related to various mathematics processes. For example, the distributive property is used in solving various types of algebra equations and is, therefore, an important process for students to commit to memory. Teachers may choose to provide a distributive property mnemonic to students:

To distribute means to give it to everyone.

The distributive property gives whatever is outside the parentheses to everything inside:

$$a(b + c) = ab + ac$$

9. Create a language-rich classroom.

As noted earlier, explicit instruction of related vocabulary should be a consistent part of the lesson. One teacher of secondary students with mathematics difficulties required her students to keep a math vocabulary notebook. In the notebook, students wrote their own definitions of vocabulary words, provided pictorial examples, and practiced spelling the vocabulary words through word pyramids by writing the words in a series of lines, starting with the first letter on the first line, the first two letters on the second line, the first three letters on the third line, and so on. The point of the vocabulary notebooks was to promote literacy across the content areas and to establish the fact that mathematics is abundant with literacy opportunities.

Carrie Stewart uses hands-on and real-life examples to teach. She likes using the newspaper to generate problems that coincide with the skills she’s teaching. For example, newspapers can be used to connect current events to math activities. Problem-solving, probability, and data analysis activities can use poll

results, weather data, or scores of sporting events from the newspaper.

Vocabulary instruction is one aspect of creating a language-rich environment. Teachers and students should practice using appropriate mathematics terminology in the classroom, in a type of immersion class. Students should also regularly be asked to discuss their problem solving by explaining to the teacher or to a fellow student. In addition, students should be required to write out their explanations for their problem-solving steps and solutions to problems.

10. Use Web-based math instruction for credit recovery and individualized support.

Online learning has great potential for use in detention facilities, where there is high student mobility, variable lengths of stay, and a wide range of ability. In many jurisdictions, access to Web-based content raised security concerns. However, many States have developed systems that provide security and access to appropriate education material and programs while restricting student access to prohibited Web sites and content.

“Youth are always learning to use technology and using technology to learn. For example, the use of Khan Academy can aide expansion of their mathematical reach and be a tool for problem solving. When they are stuck on an equation and need an example, it is often a click away.”

Frank Martin, Justice Education | World Possible

Online instructional programs require highly skilled teachers who can support instruction in a blended learning format. Without adequate supervision or qualified teachers, online instruction can lead to less student engagement and achievement. What may be engaging computer work to some students can lead others to become bored, race through material by guessing, or rely on other students for answers. In addition, the lack of quality control and temptation for quick results may lead to overreliance on online resources and inadequate review and assessment of newly learned material outside of the online program. A large-scale study of online versus traditional algebra instruction for at-risk urban students did not show measurable advantages of online credit recovery over traditional math instruction.²⁰ However, the heterogeneity

²⁰ Heppen, J. B., Sorensen, N., Allensworth, E., Walters, K., Rickles, J., Taylor, S. S., & Michelman, V. (2017). The struggle to pass algebra: Online vs. face-to-face credit recovery for at-risk urban students. *Journal of Research on Educational Effectiveness, 10*(2), 272–296.

of a detention center classroom and the need for students to finish a geometry or Algebra II course suggest that online instruction taught in a blended learning format should be available to supplement face-to-face instruction. Class periods could begin and end with math mini-lessons, and teachers could scaffold online work with note sheets or personalized supports. Blended learning combines the benefits of direct teacher interaction and progress monitoring with the online environment that can be self-paced, accessible, and motivating for students.

Recommendation 4: Provide an environment that supports teachers, promotes educational leadership, and fosters high-quality mathematics instruction and numeracy.

Teachers and administrators in juvenile detention programs face many challenges, some similar to those in mainstream secondary education settings and some unique to their programs. These include staff knowledge of and capacity for high-quality instruction in mathematics, financial resources to build capacity and change instructional offerings, and highly mobile staff and students.

The following strategies can help facilities develop a setting that supports adolescent learners and anticipates and responds to the negative experiences many students have had in learning mathematics and becoming math literate.

1. Establish a culture that celebrates the importance of mathematics and numeracy.

Many of the strategies mentioned in this guide contribute to establishing a mathematics-focused program culture. Asking students about mathematical abilities and numeracy skills during screening and diagnostic testing, setting high expectations for mathematics achievement, and creating a language-rich classroom all communicate to students that mathematics matters. A focus on increasing students’ mathematical abilities reinforces the message that the juvenile justice facility is a place for learning. Current events, sports, and popular culture all provide opportunities for teachers to publicly post, discuss, and introduce mathematical concepts to students. During class warm-up time, as part of instruction, or during closing, teachers can pose questions such as these:

- Which new movie will gross the most money during the next week? Does it matter that some movies are shown in more theaters than others?
- How do hospitals determine how many pints of blood they need for emergencies? How would you estimate how much they would need?

How much money do you think the [local sports team] grosses during the year from sale of tickets to its games? How much net profit do you think the team makes from each game? How would we figure that out?

Posing questions like these in the classroom helps students understand that using mathematical concepts and skills is an everyday phenomenon. It also demonstrates that all staff, administrators and teachers alike, value mathematics and numeracy and expect that all students are capable of using mathematics and basic numeracy skills to understand their world and solve problems.

2. Devote sufficient resources to support changes in instructional practice.

Administrators in detention facilities can play a leadership role in demonstrating the value they place on the recommendations in this guide by supporting ongoing professional development for teachers and providing appropriate classroom materials. Creating a program that supports the development of mathematics proficiency requires adequate space, well-trained personnel, and appropriate instructional tools.

3. Provide intensive interventions to address specific areas of weakness and build areas of strength.

Some adolescents, particularly those who struggle with mathematics and foundational numeracy, have significant gaps in their ability to conceptualize and think numerically. These youth need intensive, specialized instruction that builds on areas of strength and focuses on the essential elements of knowledge and skill that are weak. Individual and small-group instruction may be able to provide the critical support that these students need to succeed.

Models for intervention include intensive individual or small-group instruction that supplements or replaces regular instruction. For example, students with the most significant needs may be pulled out for assistance instead of participating in regular mathematics class. Sometimes intensive interventions are offered after school or during other times when school is not in session. Instruction that makes a difference and is associated with achievement gains is intensive, is regularly scheduled for an extended period, and targets students’ identified needs.

A variety of options exist for providing intensive supports. First, teachers should plan lessons that focus on critical information that every student should know. Students who have mastery of those concepts and skills can be assigned enrichment problem-solving activities individually or in small groups. Students may work in small groups based on math ability. After an initial brief lesson with the whole

group, the teacher or an instructional assistant can rotate through the groups and to individual students during the remainder of the class period. The key to successfully delivering intensive supports is setting up a classroom environment that demands responsibility and self-control on the part of all scholars. The expectations should be consistent and clear with the students and all staff in the room.

The cost of purchasing commercially developed intervention programs and training teachers to use this material may present a challenge to program administrators. Identifying instructional priorities and the needs of students should help determine how to spend Title I, Part D funds as well as other supplemental State and local funds. Facilities should consider the unique needs, including high mobility, of students in detention before choosing expensive commercially developed programs.

Even a small amount of time in an intensive intervention class can make a difference for students. Pulling students out of class for intensive services and supports does not conflict with the concept of educating students eligible for special education in the least restrictive environment, particularly when these students have been remarkably unsuccessful learning mathematics in larger group settings in the past.

Leinwand, in Accessible Mathematics: 10 Instructional Shifts That Raise Student Achievement, offers a number of suggestions for thinking differently about how to create a classroom culture that supports high-quality mathematics instruction and numeracy.

4. Provide professional development opportunities to strengthen teachers' understanding of mathematics and basic numeracy.

Few administrators and teachers in juvenile corrections have been trained to focus on mathematics and numeracy for their students. Typically, developing literacy and reading skills takes precedent when identifying instructional priorities. The recommendations in this guide suggest how promoting and supporting student engagement, carefully assessing the skills of students at entry and as they move through the curriculum, and providing explicit instruction can help teachers help students in short-term facilities further develop critical mathematics skills and basic numeracy.

Professional development that describes ways of engaging students and examples of instructional practice has great

potential to transform teaching mathematics in detention and other short-term settings. Well-developed sessions encourage teachers to practice new strategies, such as making progress monitoring an integral part of classroom routines and using culturally relevant practice. Providing examples of flexibility in instructional planning and setting high expectations for student performance are also essential elements for staff development.

Finally, classroom management is a perennial component of staff development sessions. The strategies described under Recommendation 1: Promote student engagement and a classroom environment conducive to learning are critical to minimizing classroom disruptions and distractions. Students who are actively engaged, who care about what is going on in class because they are competing with classmates in a group activity that involves estimating, computing, and proving or disproving the “facts” of some activity are motivated to succeed.

Recommendation 1 advises teachers to open their classrooms in ways that will welcome and involve students and help them think of themselves as learners. Teachers need clear directions for making such a shift, and they need support as they try out the strategies to make this happen.

When teachers examine their classroom management styles, they can deepen their understanding of the interpersonal aspects of teaching and learning and promote greater student engagement and motivation. Becoming culturally competent²¹ and developing the ability to “not chase every fire engine”—or knowing which behaviors to ignore and which ones deserve corrective action—are part of this process. Increasing the amount of classroom discussion, peer interaction, and individualized attention can motivate and engage students. However, when activities do not go as planned or when their authority is challenged, teachers need to be able to talk with a fellow teacher or an administrator about specific situations and develop problem-solving strategies. Over time while working in juvenile corrections, teachers develop a sense of which patterns of behaviors suggest the need to refer a youth for mental health services and which behaviors pose a serious threat to the safety and security of the teacher and other students.

In addition to regularly scheduled staff development activities, teachers in short-term facilities should have the opportunity to visit similar facilities to learn from colleagues and share their expertise. It is too easy for teachers in correctional settings to become isolated and to feel cut off from their colleagues. A staff development

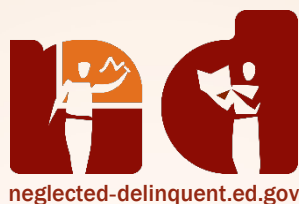
²¹ Gay, G. (2018). *Culturally responsive teaching: Theory, research, and practice* (3rd ed.). New York, NY: Teachers College Press.

program that links teachers in short-term facilities to evidence-based instructional practices and educators in similar settings will provide support and opportunities for professional growth.

Making Our Classrooms Count

Numeracy skills are critical life skills. The ability to understand and make sense of numeric information is crucial for employment, health, and accessing and using technology in the 21st century. Despite high rates of mobility and students with a wide range of abilities, teachers in juvenile corrections can help youth understand the relevance of mathematics abilities through engaging, hands-on instructional activities. The recommendations and strategies in this guide are designed to reinforce the idea that teachers can design and implement activities that help youth develop or strengthen their mathematics abilities while in detention or commitment facilities.

Short lengths of stay can present an opportunity for discouraged learners to get on track and develop a better understanding of themselves as learners. For mathematics, the goal is to encourage students to examine, estimate, calculate, explore, and use multiple intelligences to help them solve problems and apply concepts in situations that may have multiple solutions, instructive wrong answers, and individual and group problem solving. Project-based learning, supportive classroom environments, and Web-based tools enable programs to tailor instructional activities to individual needs and variable lengths of stay. Helping students develop critical mathematics competencies can improve the odds that youth will successfully reenter their communities and continue their education or obtain employment.



The National Technical Assistance Center for the Education of Neglected or Delinquent Children and Youth

American Institutes for Research
1000 Thomas Jefferson Street NW
Washington, DC 20007-3835

For more information, please contact NDTAC at ndtac@air.org or visit our
Web site at <https://neglected-delinquent.ed.gov/>.

October 2018

Improving educational
programming for youth
who are neglected or delinquent

